WHAT IS CLAIMED IS:

1. A wavelength converter comprising:

an optical/electrical signal converter for converting input optical signals into electric digital signals;

a clock generation unit connected to said optical/electrical signed converter for automatically identifying a signal transmission mode for said electrical digital signals and generating phase-synchronized clock signals with a specified frequency that matches the signal transmission mode;

a timing regeneration circuit connected to said clock generation unit for regenerating a clock timing for said electrical digital signals based upon the phase-synchronized clock signals that are generated from said clock generation unit; and

an electrical/optical converter connected to said timing regeneration circuit for converting the electrical digital signals that are outputted from said timing regeneration circuit into optical signals with a specified wavelength for wavelength-division multiplexed transmission.

2. The wavelength converter according to Claim 1, wherein said clock generation unit further comprises:

an oscillator for generating phase-controlled clock signals according to said electrical digital signals;

a frequency divider for dividing the phase-controlled clock signals from said oscillator to generate an output clock frequency; and

an auto-clock controller connected to said frequency divider for changing and controlling a division ratio for said frequency divider so that the auto-clock controller locks the division ratio of said frequency divider when the output clock frequency of said frequency divider indicates a specific match with a reference clock frequency that depends on the transmission mode for said electrical digital signals.

3. A wavelength converter comprising:

an optical/electrical signal converter that converts input optical signals into electrical digital signals;

a phase-synchronized oscillator circuit for generating clock signals each having an output clock frequency according to a transmission mode, said phase-synchronized oscillator being phase-controlled according to said electrical digital signals.

a timing regeneration circuit connected to said phase-synchronized oscillator for regenerating a clock timing signal for said electrical digital signals based upon the clock signals that are generated from said phase-synchronized oscillator circuit;

an electric/optical converter connected to said timing regeneration circuit converting the electrical digital signals that are outputted from said timing regeneration circuit into optical signals of a specified wavelength; and

an auto-clock controller connected to said phase-synchronized oscillator circuit for controlling the clock signal of said phase-synchronized oscillator circuit based upon a comparison between a reference clock corresponding to a signal transmission mode of the electrical digital signals and the clock signals.

4. The wavelength converter according to Claim 3, wherein said phase-synchronized oscillator circuit further comprises:

a voltage control oscillator;

a first frequency divider with a variable division ratio connected to said voltage control oscillator for dividing an output clock from said voltage control oscillator and outputs output clock signals from said phase-synchronized oscillator circuit, and

a phase frequency comparator connected to said first frequency divider for controling said voltage control oscillator according to a comparison between the output clock signals from said first frequency divider and said electrical digital signals,

whereby said auto-clock controller changes and controls the variable division ratio for said first frequency divider, and when the comparison between the reference clock and the output clock signal from said first frequency divider assumes a state, the auto-clock controller locks the division ratio for said first frequency divider.

5. The wavelength converter according to claim 4 further comprising:

means for generating a plurality of reference clock signals of predetermined frequencies according to the signal transmission mode; and

means for detecting a matched pair of one of said reference clock signals and said clock signal to generate a match detection signal,

wherein said auto-clock controller locks the output clock frequency of said phase-synchronized oscillator circuit according to the match detection signal from said detection means.

6. The wavelength converter of according to claim 3, further comprising:

a plurality of oscillators of different oscillation frequencies for generating output clock signals signal transmission modes;

a frequency divider for dividing the output clock signal from one of said oscillators selected by said auto-clock controller with a division ratio specified by said auto-clock controller; and

a detector detecting a matching state between the reference clock that is output from said frequency divider and said output clock signal,

whereby said auto-clock controller locks the output clock frequency from said phase-synchronized oscillator circuit according to the match detection signal from said detector.

7. The wavelength converter according to Claim 3 further comprising:

an oscillator for generating fundamental clock signals;

a counter for counting said fundamental clock signals in a counting period that is proportional to a cycle of the clock signals from said phase-synchronized oscillator circuit; and

a comparison means for comparing the count value obtained by said counter with a reference clock count that is pre-stored according to the signal transmission mode to generate a match detection signal;

whereby said auto-clock controller locks the output clock frequency in said phase-synchronized oscillator circuit according to the match detection signal from said comparison means.

8. An optical communication apparatus comprising:

a first clock generation circuit for automatically identifying a transmission mode for transmission digital signals and for generating phase-synchronized clock signals with a specified frequency that matches the signal transmission mode;

a first timing regeneration circuit connected to said first clock generation circuit for regenerating clock timing for the transmission digital signals based upon the phase-synchronized clock signals from said first clock generation circuit;

a first electric/optical converter connected to said first timing regeneration circuit for converting the transmission digital signals from said first timing regeneration circuit into first optical signals at a specified wavelength, said first electric/optical converter transmitting the optical signals to an optical network node;

a first optical/electrical converter connected to the optical network node for converting the optical signals at a specified wavelength that are received from an optical network node into electrical, received digital signals;

a second clock generation circuit connected to said first optical/electrical converter for automatically identifying the transmission mode for the electrical digital signals from said optical/electrical signal converter and for generating phase-synchronized clock signal at a specified frequency that matches the signal transmission mode of the electrical digital signals; and

a second timing regeneration circuit connected to said second clock generation circuit for regenerating the clock timing for the electrical received digital signals based upon the phase-synchronized clock signals from said second clock generation circuit.

9. The optical communication apparatus according to claim 8 further comprising:

client equipment connected to said second timing regeneration circuit;

a second optical/electrical signal converter connected to said client equipment for converting the transmission optical signals received from said client equipment into the transmission digital signals; and

a second electric/optical converter connected to said second timing regeneration circuit for converting the electrical received digital signals from said second timing regeneration circuit into second optical signals and for transmitting the second optical signals to the client equipment.

10. A wavelength division-multiplexing optical communication apparatus comprising:

a clock generation circuit for automatically identifying a signal transmission mode for transmission digital signals and for generating phase-synchronized clock signals with a specified frequency that matches the signal transmission mode;

a timing regeneration circuit for regenerating clock timing of the transmission digital signals based upon the phase-synchronized clock signals from said clock generation circuit;

an electric/optical converter connected to said timing regeneration circuit for converting the transmission digital signals from said timing regeneration circuit into optical signals at a specified wavelength; and

a wavelength division-multiplexing optical transmission equipment connected to said electric/optical converter for wavelength-multiplexing the optical signals from said electric/optical converter with optical signals at other wavelengths and for transmitting the optical signals to an optical network.

11. A wavelength division-multiplexing optical communication apparatus comprising:

a wavelength separator for separating first optical signals of a specified wavelength from wavelength-multiplexed optical signals that are received from an optical network;

an optical/electrical signal converter connected to said wavelength separator for converting the first optical signals of a specified wavelength received from said wavelength separator into electrical digital signals;

a clock generator circuit connected to said optical/electrical signal convertor automatically identifying a signal transmission mode for the electrical digital signals from said optical/electrical signal converter and for generating phase-synchronized clock signals of a specified wavelength that matches the signal transmission mode;

a timing regeneration circuit connected to said clock generator circuit for regenerating clock timing for said electrical digital signals based upon the phase-synchronized clock signals from said clock generator circuit; and

an electric/optical converter connected to said timing regeneration circuit for converting the electrical digital signals from said timing regeneration circuit into second optical signals of a specified wavelength.